Abstract View

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Entropy Generation In the Ocean by Small-Scale Mixing

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ABSTRACT

An expression that includes salt diffusion was developed and evaluated for the rate of entropy production σ in the ocean. The evaluation was done for mixing events produced by turbulent overturns and double diffusion. Temperature and salinity profiles from four representative oceanic regimes were used in the evaluation. For typical mid- or low-latitude profiles thermal diffusion is the main component of σ in upper-ocean turbulent events; in abyssal waters, viscous dissipation is the principal component. The depth of transition from dominance by σ_t to dominance by σ_v depends upon the depth dependence of mixing intensity, which has not been determined. Salt diffusion plays a major role only in a few locations where salinity strongly dominates the density field; the most prominent example is the shallow arctic halocline. Elsewhere, the effect of salt diffusion, However, when the viscous dissipation within the well-mixed layers above and below salt-fingering interfaces is also considered, viscous dissipation may be the dominant factor. The possible effect of viscous dissipation and the heat of mixing in the heat equation is also considered and found to be negligible unless strong turbulent dissipation rates are found in the bottom boundary layer, or intense mixing events occur in arctic haloclines.